REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically Applicants have amended claim 10 to recite that the photosensitive resin composition "comprises" (rather than consists essentially of) the components (1)-(3). In addition, Applicants have further amended claim 10 to recite that the polyimide precursor (component (1)) is produced using an oxydiphthalic acid or acid anhydride thereof and at least one diamine as reactants for forming the polyimide precursor, and wherein this at least one diamine "consists of" at least one diamine selected from a specified group thereof. In light of the amendments of claim 10, claims 3, 12, 13, 17, 19, 20 and 21 have been amended to recite that the at least one diamine used in producing the polyimide precursor "consists of" the specified diamine compound or "consists of" at least one diamine selected from a specified group of diamine compounds. Furthermore, a typographical error has been corrected in claim 20.

In addition, claim 25 has been set forth in independent form. Noting, for example, the statement by the Examiner in Item 4 on pages 4 and 5 of the Office Action mailed August 23, 2005, it is respectfully submitted that claim 25 should now be allowed.

Moreover, Applicants are adding new claims 26-37 to the application. Claims 26 and 27, dependent respectively on claims 10 and 19, recite that the composition "consists essentially of" the polyimide precursor, the addition-polymerizable compound and the photoinitiator, in an organic solvent. Note, for example, claim 10 as considered by the Examiner in the Office Action mailed August 23, 2005, as well as Examples 1-6 on page 22 of Applicants' specification, for example. Claim 28 and 29, dependent respectively on claims 23 and 25, recite that the specified

components are in a solvent. Claim 30, dependent on claim 10, recites that the polyimide precursor is produced by using the specified acid or acid anhydride and the at least one diamine as reactants "in an organic solvent" (note page 10 of Applicants' specification), with claim 31, dependent on claim 30, further defining the organic solvent as described, for example, in the last full paragraph on page 10 of Applicants' specification. Claims 32 and 33, dependent respectively on claims 10 and 32, define the number average molecular weight of the polyimide precursor, consistent with the description in the paragraph bridging pages 11 and 12 of Applicants' specification. Claims 34 and 36, dependent respectively on claims 10 and 19, recite that the specified components are provided in an organic solvent; and claims 35 and 37, dependent respectively on claims 34 and 36, recite that the composition is a solution of the specified components in the organic solvent.

The Examiner is thanked for the indicated allowance of claim 23, as set forth in Item 5 on page 5 of the Office Action mailed August 23, 2005; and, in addition, Applicants thank the Examiner for the indicated allowability of the subject matter of claim 25. In view of present amendments to claim 25, it is respectfully submitted that claim 25, as well as claim 23, is clearly allowably based upon statements by the Examiner in the Office Action mailed August 23, 2005.

As for the remaining claims, Applicants respectfully submit that all of the remaining claims patentably distinguish over the teachings of Hagiwara, et al., No. 5,472,823, under the provisions of 35 USC 102 and 35 USC 103.

Initially, as established previously, and noting the Statement in the second full paragraph on page 7 of the Supplemental Preliminary Amendment filed February 26, 2004, in the above-identified application, Applicants respectfully submit that U.S. Patent No. 5,472,823 is disqualified as prior art under 35 USC 103.

Moreover, it is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested such a photosensitive resin composition as in the present claims, which includes the components (1)-(3) of claim 10, with the components including a polyimide precursor produced using, inter alia, at least one diamine as a reactant for forming the polyimide precursor, wherein this at least one diamine consists of at least one diamine selected from the specified group of diamines as in claim 10.

As will be discussed further infra, it is respectfully submitted that Hagiwara, et al. requires a diamine which is not in the group set forth in claim 10, and thus Hagiwara, et al. would have taught away from such photosensitive resin composition as in the present claims, including the polyimide precursor produced using, as a reactant, the at least one diamine consisting of at least one diamine selected from the specified group set forth in claim 10.

In addition, it is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested such a photosensitive resin composition as in the present claims, including the components thereof which include the specified polyimide precursor, utilizing the at least one diamine consisting of at least one diamine selected from the specified group, and, moreover, wherein the composition is adapted to be exposed and developed using an i-line stepper which uses monochromatic light, and wherein the polyimide precursor is such that a 20 μm thick film thereof has a transmittance, at 365 nm, of at least 40%. Note claim 10.

Moreover, it is respectfully submitted that the applied reference would have neither taught nor would have suggested the other features of the present invention as in the remaining, dependent claims, having features as discussed previously in

connection with claim 10, and further including (but not limited to) wherein such at least one diamine used in producing a polyimide precursor consists of at least one diamine selected from the specified diaminodiphenyl ethers as in claim 17; and/or wherein the at least one diamine used in producing the polyimide precursor consists of at least one diamine selected from the group as set forth in claim 19, more particularly as set forth in claim 20; and/or wherein the polyimide precursor is a condensation product of the oxydiphthalic acid or acid anhydride thereof and the at least one diamine (see claim 24); and/or wherein the at least one diamine used in producing the polyimide precursor consists of a diaminodiphenyl ether (see claims 12 and 13); and/or wherein such at least one diamine, consisting of the at least one diamine selected from the recited group in claim 10, includes a diaminopolysiloxane as in claim 21, more particularly as in claim 22 (see also claim 3); and/or wherein the transmittance of the composition is in a range of 40%-68% (see claim 4); and/or wherein the polyimide precursor is formed in an organic solvent (see claims 30 and 31), or the composition includes an organic solvent (see claims 26-29 and 34-37).

The present invention is directed to a photosensitive resin composition, adapted for use with an i-line stepper.

Development of heat-resistant photosensitive materials, which enables the required portion of the resist material to remain, e.g., as a pattern on a semiconductor integrated circuit device after the pattern is formed by exposure to light and development, has been desired. Previously known materials have utilized a g-line stepper, which employs a visible light of a wavelength of 435 nm.

However, as further reduction of processing rule in the production of semiconductor devices has occurred, it is required to shorten the wavelength of the

stepper used for carrying out finer processing. Thus, an i-line stepper having a wavelength of 365 nm has increasingly been used instead of the g-line stepper having a wavelength of 435 nm.

A base polymer of, e.g., a conventional photosensitive polyimide designed for a contact/proximity exposing machine, or a g-line stepper, has substantially no transmittance particularly for the i-line having a wavelength of 365 nm. Moreover, a relatively thick polyimide film has been required for surface protection of a lead-on-chip device, and when such a thicker film is used, the low light transmittance for light of the i-line stepper causes more serious problems.

Against this background, Applicants provide a photosensitive resin composition overcoming problems of previously known photosensitive resin compositions, providing a composition which can be used with excellent image-forming ability with an i-line stepper, and which also has excellent film-forming, heat-resistance and adhesive properties. Applicants have found that with a photosensitive resin composition including, in addition to an addition-polymerizable compound and a photoinitiator, a polyimide precursor formed using an oxydiphthalic acid or acid anhydride thereof and at least one diamine consisting of at least one diamine selected from the group recited in claim 10, more particularly consisting of at least one diamine as recited in various of the other present claims, the polyimide precursor being such that a 20 μm thick film thereof has a transmittance, at 365 nm, of at least 40%, objectives according to the present invention are achieved; and, in particular, the composition can be exposed and developed by an i-line stepper using monochromatic light. Moreover, this photosensitive resin composition, upon development, has excellent properties including heat-resistance properties, when used, for example, in manufacturing semiconductor devices.

Hagiwara, et al. discloses, inter alia, a diamino compound represented by the formula (I) at column 2, lines 13-20. This patent further discloses, as an aspect thereof, a poly(amic acid) resin having recurring units represented by the formula (II) at column 2, lines 25-40. This patent further discloses a photosensitive resin composition comprising (A) this poly(amic acid) resin having recurring units of the formula (II), a poly(amic acid)ester resin prepared by esterifying the carboxyl group of the poly(amic acid) resin, and/or a polyimide resin prepared by subjecting them to a dehydrating or alcohol-eliminating ring-closure; and (B) a photoinitiator as an optional ingredient. See column 2, lines 52-59. This patent also discloses, in the paragraph bridging columns 20 and 21, other diamino compounds which may optionally be used in addition to the diamino compound represented by the formula (I). Note also, for example, from column 25, line 40, through column 31, line 18, for further description of the photosensitive resin composition. In this description in columns 25-31, it is disclosed that the photosensitive resin composition may contain a polymerizable unsaturated compound. Various of the Synthesis Examples in the applied patent disclose formation of various materials, including poly(amic acid) resins. Examples 1-15, as described in column 51 and shown in Table 1 in column 52 of this patent, describe photosensitive resin compositions tested, these compositions including, in addition to the poly(amic acid) resin solution, a polymerizable unsaturated compound (in some of the examples) and a photoinitiator.

Initially, it is emphasized that Hagiwara, et al. requires a diamine of the formula (I), which includes a reactive double bond group through a urea bond at a side chain thereof. It is respectfully submitted that diamine compounds represented by the formula (I) in Hagiwara, et al. do not fall within the listed diamine compounds in claim 10. It is respectfully submitted that Hagiwara, et al. would have neither

taught nor would have suggested, and, by requiring a diamine of the formula (I), would have taught away from, such a photosensitive resin composition as in the present claims, including, inter alia, wherein the at least one diamine used in forming the polyimide precursor consists of at least one diamine selected from the group as in claim 10; and, more specifically, selected from the group as in various of the other claims, or is a diamino compound as in various of the present claims.

It is acknowledged that in the paragraph bridging columns 20 and 21 in Hagiwara, et al., additional, optional diamine compounds are listed. It must be emphasized, that these optional diamine compounds are to be used in the composition of Hagiwara, et al., in addition to the diamino compound of the formula (I). Clearly, the teachings of Hagiwara, et al. as a whole would have taught away from the polyimide precursor as in the present claims, produced using, inter alia, at least one diamine consisting of at least one diamine selected from the specified group(s) or specific compounds as in the present claims.

In the first full paragraph on page 4 of the Office Action mailed August 23, 2005, the Examiner addresses the "consisting essentially of" language as previously in claim 10. Note, however, as presently amended, the at least one diamine used in forming the recited polyimide precursor consists of at least one diamine selected from the list of diamines in claim 10. Thus, it is respectfully submitted that the present claims, including claim 10, more specifically define the diamine used in forming the polyimide precursor recited in the present claims, such that Hagiwara, et al. would have neither disclosed nor would have suggested, and in fact would have taught away from, the presently claimed subject matter.

The Examiner contends, on page 3 of the Office Action mailed August 23, 2005, that Examples 2, 3, 6, 8, 9, 13 and 14, found in Table 1 of Hagiwara, et al.,

anticipate the claimed invention. This conclusion by the Examiner is respectfully traversed, particularly with respect to the present claims. That is, in all of the examples in Hagiwara, et al., a diamine component, for forming the poly(amic acid) or ester thereof, is used that includes the diamine compound represented by the formula (I), referred to previously, in column 2 of Hagiwara, et al. It is respectfully submitted that the Examples in Hagiwara, et al. would have neither taught nor would have suggested the composition wherein the diamine used in forming the polyimide precursor consists of at least one diamine of those listed in the present claims, and advantages thereof, including, inter alia, having the increased transmittance at 365nm.

As to the specific examples of Hagiwara, et al. referred to by the Examiner on page 3 of the Office Action mailed August 23, 2005, it is to be noted that while Synthesis Example 20, used in Example 14, includes at least one of the diamines as listed in claim 10, it also includes a diamine not listed in the present claims, and it does not include a oxydiphthalic acid or anhydride thereof. Moreover, Synthesis Example 19, having at least one of the diamines, does not have the anhydride or acid (having instead an oxydiphthalate).

It is noted that Synthesis Example 7 bridging columns 45 and 46 of Hagiwara, et al., used in Example 2, uses oxydiphthalic acid anhydride and 4, 4'-diaminodiphenyl ether. However, this Synthesis Example 7 also uses 4, 4'-bis[3-(2-methacryloyloxyethyl)ureido]-3, 3'-diaminobiphenyl, not listed in the diamines in claim 10; and it is respectfully submitted that this Synthesis Example 7 would not have anticipated a resin composition wherein the at least one diamine used in forming the polyimide precursor consists of the at least one diamine listed in claim 10. The other Synthesis Examples providing materials for Examples 3, 6, 8, 9, 13

and 14 (see Synthesis Examples 8, 11, 13, 14, 19 and 20) of Hagiwara, et al. include a diamine not listed in, e.g., claim 10, and thus would not have disclosed or suggested the polyimide precursor formed using at least one diamine consisting of diamines from the recited group.

In addition, it is emphasized that the present claims recite that the photosensitive resin composition is adapted to be exposed and developed using an i-line stepper which uses monochromatic light, and that the polyimide precursor is such that a 20 μm thick film thereof has a transmittance, at 365 nm, of at least 40%. It is respectfully submitted that Hagiwara, et al. is silent in connection with use of an i-line stepper, and does not indicate transmittance thereof to monochromatic light of a wave length of 365 nm. The additional diamine components used in forming the poly(amic acid) resin of Hagiwara, et al., not listed among the diamines set forth in the present claims, are again noted. It is respectfully submitted that Hagiwara, et al. would have neither taught nor would have suggested the presently claimed composition, including the property thereof in which it is adapted to be exposed and developed using an i-line stepper which uses monochromatic light; and/or the property of the polyimide precursor, wherein the polyamide precursor is such that a 20 μm thick film thereof has a transmittance, at 365 nm, of at least 40%, and advantages thereof as discussed previously.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims remaining in the above-identified application are respectfully requested.

Applicants request any shortage in fees due in connection with the filing of this paper be charged to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (case 511.33114CC6) and credit any excess fees to such deposit account.

Respectfully submitted,

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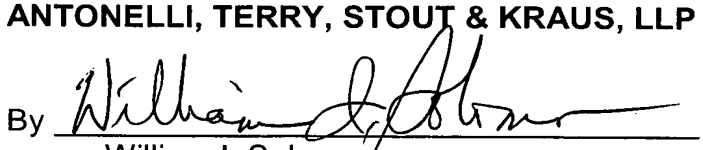
By 
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